

14 bone of the ...  
 Radius head  
 Patella  
 rib whole  
 rib cortex  
 vertebra  
 sternum

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TABLE 3  
 DISTRIBUTION OF PLUTONIUM IN HUMAN TISSUES FOLLOWING  
 INTRAVENOUS INJECTION OF PLUTONIUM SALTS

Tissue (2)	Subject and % of Injected Dose/g of Tissue								Rel. Pu Affinity (3)	Org. Wt./g (4)	Calc. %/Organ
	Hp-5	Hp-9	Hp-11	Chi. I	Chi. II	Hp-12	Cal. I	Av. %/g			
Bone Marrow	--	--	.0096	.0153	.0210	--	.0290	.0187	13.3	3,000	(56.1)(6)
Radius (Frag. head)	--	--	--	--	--	.0187	--	--	--	--	--
Liver	.0320	.0144	.0063	.0139	.0094	--	--	.0136	9.7	1,700	23.1
Rib (Cortex)	--	--	--	.0015	.0196	--	.0170	.0127	9.1	--	--
Patella	--	--	--	--	--	.0109	--	--	--	--	--
Vertebra	.0071	.0080	.0070	--	--	--	--	.0073	5.2	7,330 10,000 SKELETON	--
Sternum	.0020	--	.0100	.0044	--	--	--	.0071	5.1		65.7(5)
Rib (Whole)	.0050	.0038	.0068	--	--	--	--	.0052	3.7		--
Periosteum (Rib)	--	--	--	.0043	.0019	--	.0048	.0037	2.6		--
Spleen	.0007	.0015	.0048	.0024	.0014	--	.0019	.0021	1.5		200
Kidney	.0002	.0002	.0015	.0004	.0054	--	--	.0015	1.0	300	0.4
Thyroid	.0001	--	.0009	--	.0034	--	--	.0014	1.0	30	--
Adrenal	.0004	--	.0022	--	--	--	--	.0013	1.0	14	--
Lung	.0005	--	.0016	.0006	.0016	--	--	.0011	0.8	950	1.0
Pancreas	.0002	.0002	--	--	.0022	--	--	.0009	0.6	65	--
Gonads	.0003	--	.0012	.0005	.0009	--	--	.0007	0.5	--	--
Lymph Node	--	--	--	.0014	.0001	--	--	.0007	0.5	700	0.5
Teeth (Av. of 7)	--	--	--	--	--	.0003	--	--	--	--	--
Heart	.0000	.0000	--	.0003	.0011	--	--	.0003	0.2	350	0.1
Large Intestine	.0002	--	.0004	--	.0001	--	--	.0002	0.1	2,300	0.5
Small Intestine	.0001	--	.0005	--	.0001	--	--	.0002	0.1		--
Muscle and Skin	.0000	--	.0002	.0002	.0001	--	--	.0001	0.1	38,500	3.9
Blood	--	--	--	--	--	--	--	--	--	5,400	0.2(8)
Balance	--	--	--	--	--	--	--	.0001(7)	--	9,600	0.9
Total	--	--	--	--	--	--	--	--	--	70,000	96.7

- (1) The various subjects received the following doses of plutonium: Hp-5 = 6.3 µg; Hp-9 = 6.3 µg; Hp-11 = 6.5 µg; Chi. I = 6.5 µg; Chi. II = 94.9 µg; Hp-12 = 4.7 µg; Cal. I = 103 µg.
- (2) Tissues were obtained at the following times after injection: Hp-5 151 days; Hp-9 456 days; Hp-11 5 days; Chi. I 155 days; Chi. II 16 days; Hp-12 5 days; Cal. I 4 days.
- (3) Calculated by dividing %/g of tissue by %/g of body weight if a unit dose of Pu was equally distr. in a 70 Kg. man.
- (4) Hermann Lisco, Memorandum to AEC, July 21, 1947, Project Standard Man.
- (5) Assumption made that vertebra, sternum and whole rib represent average bone of skeletal system.
- (6) Bone marrow not included in total recovery because bone samples were not freed of marrow before analysis.
- (7) Balance assumed to have same Pu content as muscle.
- (8) Value for blood taken at 30 day point, Fig. 3.

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Table 1. (Part 1)

Material balances of soft tissues and excreta. Six persons injected i. v. with Pu(IV) citrate, Pu(VI) nitrate, or Pu(VI) citrate

	Pu(IV) Citrate			Pu(IV) Citrate			Pu(IV) Citrate		
	HP-5, 151 days p. i. Male, 56 yr. 70.8 kg <sup>a</sup>			HP-9; 456 days p. i. Male, 66 yr. 63 kg			HP-11; 5 days p. i. Male, 68 yr. 70.8 kg <sup>a</sup>		
	% Pu/g	wt (g)	Calc. (% dose)	% Pu/g	wt (g)	Calc. (% dose)	% Pu/g	wt (g)	Calc. (% dose)
Liver	0.032	1,340 <sup>b</sup>	42.8	0.0144	1,600 <sup>b</sup>	23.0	0.0053	2325	12.3
Spleen	0.0007	184	0.13	0.0015	162	0.24	0.0048	184	0.89
Kidney	0.0007	312	0.02	0.0002	277	0.055	0.0015	312	0.47
Lung	0.0005	1,000	0.50				0.0016	1,000	1.60
Pancreas	0.0002	100	0.02	0.0002	90	0.018			
Intestines	0.00015	1,020	0.15				0.00045	1,020	0.46
Testes	0.0003	64	0.018				0.0012	64	0.077
Thyroid	0.0001	16	0.0016				0.0009	16	0.014
Adrenals	0.0004	14	0.0056				0.0022	14	0.031
Muscle	0.0007 <sup>c</sup>	28,400	6.67	0.0002 <sup>c</sup>	25,200	5.92	0.0002	28,400	5.68
Skin		4,950			4,410		0.0002	4,950	0.99
Residual soft tissue	0.0001 <sup>d</sup>	23,060	2.31	0.0001 <sup>d</sup>	22,280	2.23	0.0001 <sup>d</sup>	22,200	2.22
Excreted <sup>e</sup>			5.20			16.5			2.00
Total (accounted for)			57.9			48.0			34.7
Skeleton (calc.)		10,300	42.1		9,166	52.0		10,300	65.3

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Footnotes to Table 1

- <sup>a</sup> Body weight estimated to be the mean weight of six male cases whose body weights were recorded.
- <sup>b</sup> Measured tissue weight.
- <sup>c</sup> Pu concentrations in muscle and skin (when not measured) were estimated to be the average of other measured soft tissues such as heart, pancreas, etc.
- <sup>d</sup> Pu concentration of residual soft tissue was estimated to be one-half the concentration in skin and muscle.
- <sup>e</sup> Measured totals are used when available. Excretion between the cessation of collections and deaths of HP-5 and HP-9 was estimated from extrapolation of the last available measurements and the slopes of the U and F curves of persons followed for longer times. Excreta from HP-11 were estimated to be the mean for all the other Pu(IV) citrate-injected cases.
- <sup>f</sup> Includes 7.95%, the average Pu content of blood of the two sickest persons (HP-4 and HP-10), from whom blood samples were obtained at this time.
- <sup>g</sup>  $\mu\text{Ci/g}$  of Pu recalculated from original data.
- <sup>h</sup> Includes 3.25% estimated from the tissues of Chi-2, and HP-11.
- <sup>i</sup> Chi-2 was emaciated; her skeleton was assumed to be the average reported by Mechanik<sup>66</sup> for slightly built females. Cal-1 had lost 15 lb during his illness; his skeletal weight was calculated from his body weight in good health, 64.8 kg.